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(54) Structured polyolefin coated substrates and process for making the same

(57) Structured polyolefin coated substrates and processes for making the same are disclosed. A chill roll is used to impart a plurality of peaks which protrude outwardly from the polyolefin coating of the structured substrate. In addition, the chill roll surface is treated to impart a matte finish and thus to transfer a matte finish to the area surrounding the peaks of the polyolefin coating.

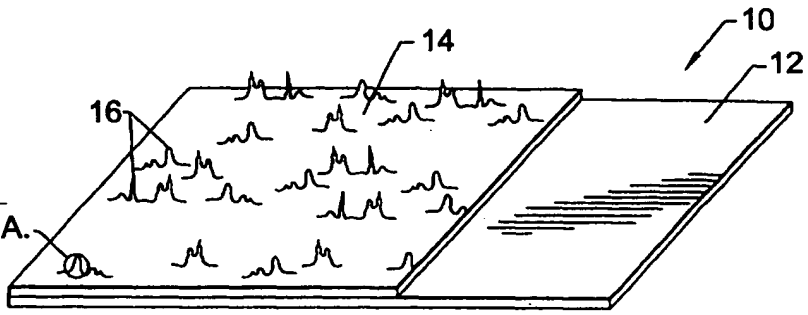

FIG. 1.

FIG. 1A.

EP 1 146 170 A1

Description

FIELD OF THE INVENTION

[0001] This invention relates to sheet materials, and more particularly to polyolefin coated sheet materials and processes for making the same.

BACKGROUND OF THE INVENTION

[0002] Polyolefin coated substrates, such as polyethylene coated paper, are known for a variety of applications. The substrates can be prepared having a variety of surface finishes, such as mirror gloss finishes, satin finishes, matte finishes, and structured finishes with peaks or projections protruding outwardly from the surface.

[0003] Polyolefin coated substrates are typically prepared by extruding a molten polyolefin polymer onto the surface of a substrate and directing the resultant coated substrate through the nip of a chill roll and pressure roll. The desired surface appearance is imparted to the polyolefin coating by selection of a chill roll having the appropriate surface characteristics, i.e., a mirror finish to impart a glossy appearance to the polyolefin coating, a pocketed roll to impart peaks to the polyolefin coated surface, and the like.

[0004] The various surface finishes can be functional, aesthetic, or both in nature. For example, a glossy surface appearance may be desirable in flexible packaging applications. In some applications, however, a given finish is detrimental to the intended function of the product. For example, polyolefin coated substrates having a glossy appearance typically have a very high coefficient of friction. This can cause handling difficulties. For example, the sheets tend to stick together when feeding a stack of glossy sheets into printing equipment.

[0005] To reduce the coefficient of friction of a glossy polyolefin coated substrate, the polymeric surface can be "structured" to impart a plurality of small peaks projecting above the surface of the polyolefin coating. The resultant surface maintains a glossy surface appearance while the creation of numerous peaks on the surface can lower frictional characteristics to improve handling in subsequent operations.

[0006] For many end uses, a glossy appearance is undesirable. For example, many end applications require a paper-like surface appearance, resulting from a matte finish of the polyolefin coating. However, substrates having a matte finish can have too low a coefficient of friction, which can result in handling difficulties as well, particularly when directing such products through manufacturing equipment, laser and/or ink jet printers, and the like. For example, while a stack of matte finish polyolefin coated sheets may separate more easily than glossy sheets, the frictional characteristics of the sheets may be so low that the sheets cannot be adequately "gripped" by guide rollers or other feed mechanisms; as result, the sheets can jam equipment.

SUMMARY OF THE INVENTION

[0007] The present invention is a polyolefin coated substrate in which the polyolefin coating has been structured to impart desirable physical and surface appearance properties thereto. The polyolefin coating has a matte surface finish, and specifically a R_a (Arithmetic Average) surface finish ranging from about 1.52 μm to about 3.81 μm, preferably from about 1.80 μm to about 3.04 μm, and most preferably from about 2.10 μm to about 2.79 μm. In addition, the polyolefin coating includes a plurality of peaks protruding outwardly from the surface thereof, the peaks having an R_z ranging from about 10 μm to about 30 μm, more preferably from about 13 μm to about 22 μm and most preferably from about 15 μm to about 20 μm.

[0008] The polyolefin coated substrate exhibits several desirable yet contradictory properties. The matte finish contributes a paper-like appearance to the substrate. However, in contrast to conventional matte finish polyolefin coated substrates, the structured surface imparts desirable surface frictional properties to the substrate, which in turn improves handling of the product, for example, when directing a stack of the sheets through feeding mechanisms associated with laser printers, digital printers, and the like. It has been found that the structured surface of the matte finish polyolefin coating can improve the frictional characteristics and feeding effectiveness of the sheet material. This is surprising in view of the industry practice of structuring glossy finish polyolefin coated substrates to decrease the frictional characteristics thereof.

[0009] The polyolefin coated substrates of the invention generally include a polyolefin coating on a surface of a suitable support substrate. Any of the types of polyolefin resins known in the art to be useful for coating a substrate can be used, and preferably is a polyethylene or polypropylene resin. Similarly, the support substrate can be any of the types of materials known in the art, but preferably is a paper substrate. The support substrate may have a polyolefin coating on one or both opposing surfaces thereof. When the support substrate includes a polyolefin coating on each surface, the coating may be formed of the same or different polyolefin material and/or may have the same or different surface characteristics, depending upon the desired properties of the product. In addition, a surface of the structured substrate may be treated so that the surface is receptive to printed indicia, for example, by corona treatment, applying an ink receptive coating, and the like.

[0010] The resultant structured polyolefin coated substrates are useful in a variety of applications. For example a release coating can be applied to a surface of the substrate opposite the structured polyolefin coating to provide a release liner. The sheets are also useful in printing applications using high speed laser or ink jet

printers because the sheets can be readily fed through high speed printing equipment with minimal jams or misfeeds. In yet another application, the structured polyolefin coated substrates can be combined with another substrate, such as a polyvinylchloride (PVC) film.

[0011] The structured polyolefin coated substrates of the invention can be prepared using an extrusion coating process. Specifically, a suitable polyolefin resin is heated and extruded as a molten film or sheet onto a surface of a support substrate. The resultant coated support substrate is then directed through the nip formed by cooperating pressure and chill rolls to set the molten polyolefin coating and adhere it to the support substrate. The chill roll is selected to impart the desired surface characteristics to the polyolefin coating. In this regard a plurality of pockets extend into the chill roll. In addition, the outer surface of the chill roll is treated to impart the desired matte finish. As a result when the molten polyolefin coating on the support substrate is directed against the chill roll surface, the chill roll transfers its surface characteristics to the polyolefin coating, i.e., imparts a plurality of peaks and a surface finish surrounding the peaks having a matte finish. The product can then be directed to a winding roll or immediately directed to additional downstream processing (such as in-line application of a release agent; etc.).

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] Some of the features and advantages of the invention having been described, others will become apparent from the detailed description which follows and from the accompanying drawings, in which:

Figure 1 is a schematic perspective view of a structured polyolefin coated substrate in accordance with the present invention with the respective layers thereof exposed for clarity of illustration;

Figure 1A is a greatly enlarged perspective view illustrating a portion of the surface of the structured polyolefin coated substrate of Figure 1, taken within ring 1A of Figure 1;

Figure 2 is a greatly enlarged cross sectional view of the structured polyolefin coated substrate of Figure 1;

Figure 3 is a photomicrograph at 35X magnification of a structured polypropylene coated paper substrate in accordance with one embodiment of the invention;

Figure 4 is a schematic perspective view of a release liner in accordance with the present invention which includes a structured polyolefin coated substrate as a component; and

Figure 5 is a schematic representation of an exemplary process for making the structured polyolefin coated substrates of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0013] The present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout.

[0014] Figure 1 is a schematic perspective view of a structured polyolefin coated substrate in accordance with the present invention, designated generally as **10**. In Figure 1, the respective layers of the structured polyolefin coated material **10** are cut away or exposed for clarity of illustration. Generally, structured polyolefin coated substrate **10** includes a support substrate **12** and a polyolefin coating **14** on a surface thereof.

[0015] As illustrated in Figure 1, in the invention, the surface topography of the polyolefin coated substrate **10** is modified to include a plurality of peaks or projections **16** projecting outwardly from the polyolefin coating surface. Figure 1A is a greatly enlarged perspective view of such a peak or projection **16** taken within ring 1A of Figure 1. Figure 2 is a greatly enlarged cross sectional view of the structured polyolefin coated substrate of Figure 1 and also illustrates peaks **16** projecting upwardly from the outer surface of the polyolefin coating **14**. It is noted that the surface topography of polyolefin coating **14** as illustrated in Figures 1, 1A, 2 and 4 is greatly enlarged for illustrative purposes and is not to scale.

[0016] Peaks **16** can vary in height and generally have an R_z ranging from about 10 μm to about 30 μm, preferably ranging from about 13 μm to about 22 μm, and most preferably ranging from about 15 μm to about 20 μm. As used herein, the average height of the peaks or projections is determined using any of several well-known surface profiling devices such as those available from WYKO or Tencor. The height of individual peaks can vary, but preferably the height variations are randomly distributed so that a number of shorter, or higher, peaks are not grouped together.

[0017] The opposing surface of the polyolefin coated substrate opposite the polyolefin coating **14** could also include a plurality of peaks projecting outwardly from the opposing surface. For example, both surfaces of the support substrate 12 can be coated with a polyolefin coating, and each of the polyolefin coatings can in turn can be topographically structured or modified.

[0018] The spacing of peaks **16** can also vary, and preferably the peaks are spaced apart to provide a contact surface of the peaks of about 0.5 to about 8 percent, preferably about 1.5 to about 4 percent, of the total surface area of the polyolefin coating **14** and a matte polyolefin coating surface area between the peaks of about

92 percent or greater of the total polyolefin coating layer.

[0019] The outer surface of the polyolefin coating **14** between the peaks **16** is characterized as having a matte finish. As used herein, the term "matte finish" refers to a surface property characterized as having an R_a (Arithmetic Average) surface finish ranging from about 1.52 μm to about 3.81 μm, preferably ranging from about 1.80 μm to about 3.04 μm, and more preferably from about 2.10 μm to about 2.79 μm. The R_a surface finish or roughness of the surface area of the polyolefin coating between the peaks **16** is determined by any of several well-known surface profiling devices such as WYKO or Tencor devices. The matte surface topography is not illustrated in the figures by reason of the small scale.

[0020] Thus, as illustrated in Figures 1, 1A, and 2, the structured polyolefin coatings of the coated substrates of the invention in currently preferred embodiments of the invention include projecting peaks that are typically irregularly shaped and randomly located across the surface of the polyolefin coating. Stated differently, the structured polyolefin surface can be described as having a generally randomized surface topography characterized by a plurality of peaks projecting upwardly therefrom and a matte surface finish between the peaks. As used herein the term "randomly located across the surface of the polyolefin coating" means that the projecting peaks do not necessarily line up in regular arrays of peaks (for example as linear columns and rows of peaks). Also as used herein the term "irregularly shaped" means that the peaks generally do not have a symmetrical cross sectional configuration (such as a conical cross section).

[0021] Figure 3 is a photomicrograph of a polyolefin coated substrate in accordance with one aspect of the invention. Specifically, Figure 3 illustrates a top plan view of a polypropylene coated paper substrate at 35X magnification. As illustrated therein, the polypropylene surface includes a plurality of peaks and surrounding matte surface area.

[0022] Support substrate **12** can be any of the types of substrates as known in the art, including without limitation polymeric substrates, such as polymer films (including metallized and voided films), polymer foams, sheets formed of synthetic staple fibers and/or filaments, and the like; cellulosic substrates, such as paper substrates (including metallized paper); substrates including both polymeric and cellulosic components, for example, sheets formed of a blend or mixture of synthetic and cellulosic staple fibers and/or filaments; metal foils; and the like.

[0023] Preferably support substrate **12** is a cellulosic substrate, and more preferably a paper substrate. Any of the types of papers conventionally known in the art for preparing coated papers can be used in the invention, such as but not limited to kraft paper, natural or synthetic pulp paper, paperboard, liner board, and the like. The paper may additionally contain conventional paper adjuvants, such as but not limited to strength increasing agents, sizing agents, dyes, fluorescent whitening agents, preservatives, fillers, antistatic agents, clay, kaolin, talc, barium sulfate, calcium carbonate, titanium dioxide, zinc oxide, and the like.

[0024] The thickness of the paper may range from about 25.4 μm (1 mil) to about 635 μm (25 mils), preferably from about 64 μm (2.5 mils) to about 381 μm (15 mils), and more preferably about 102 μm (4 mils) to about 254 μm (10 mils). The basis weight of the paper sheet generally ranges from about 20 grams per square meter to about 400 grams per square meter, although again as the skilled artisan will appreciate, paper substrates having a basis weight outside of this range can also be used. The paper can be uncoated or coated, machine finished, machine glazed, soft-nip calendered, super-calendered, bleached, semi-bleached, natural, or colored paper as known in the art.

[0025] Polyolefin coating **14** can be formed of any of the types of polyolefin resin materials known in the art useful for coating a substrate. Examples of polyolefin resins include ethylene homopolymers, copolymers, and terpolymers, such as high density polyethylene, low density polyethylene, and linear low density polyethylene; propylene homopolymers; polymethylpentene hompolymers; and copolymers, terpolymers, and blends thereof. Examples of copolymerizable monomers include alpha olefins such as styrene, vinyl acetate, acrylic acid, methyl acrylate, ethyl acrylate, acrylamide, methacrylic acid, methyl methacrylate, ethyl methacrylate, methacrylamide, 1-butene, 1-hexene, 1-octene, and diene compounds such as butadiene and isoprene. The polyolefin resin can be employed alone or in combination as in a coextruded coating. The coating weight of the polyolefin coating layer **14** can vary, and typically ranges from about 3.5 grams per square meter to about 47 grams per square meter, preferably from about 16 grams per square meter to about 28 grams per square meter, although coating weights outside of these ranges can also be used.

[0026] The polyolefin may further contain a variety of additives as known in the art, such as but not limited to fluorescent agents, whitening agents, anti-oxidizing agents, antistatic agents, releasing agents, dyes, dispersing agents, pigments, fillers and the like. The thickness of the polyolefin coating can vary, typically ranging from about 10 μm (0.4 mils) to about 51 μm (2 mils), and preferably from about 18 μm (0.7 mils) to about 31 μm (1.2 mils).

[0027] Turning now to Figure 4, another aspect of the invention is illustrated, specifically, a release liner designated generally as **20**. Release liner **20** includes a supporting or carrier substrate, such as the structured polyolefin coated substrate **10** of Figure 1. Release liner **20** also includes one or more additional and optional polyolefin layers, such as polyolefin layer **24** in Figure 4 and a release layer **26** on a surface of the substrate opposite the structured polyolefin coating. As noted above, such

additional polyolefin coatings, such as layer **24**, can be topographically structured or modified, although not required.

[0028] Release layer **26** can include any of the types of agents known in the art which impart release properties to a substrate. For example, release layer **26** can be a coating of a release agent, such as a fluoropolymer, silicone, chromium complexes of long chain fatty acids, and the like. Typically, such release agents are cured by any of several techniques, such as by heat, by electromagnetic radiation, such as ultraviolet (UV), electron beam, and the like, by moisture, and the like, as known in the art. Release layer **26** can also be cured by evaporative processes as known in the art, i.e., dried to remove solvent. Exemplary release agents include without limitation SYL-OFF® 294 with Dow Corning 176 Catalyst, commercially available from Dow Corning; UV9315 with UV9310C catalyst, commercially available from General Electric Silicones, and Quilon®, commercially available from E.I. DuPont. Corona treatment can advantageously be used to promote adhesion of the release agent to the surface of the structured polyolefin coated substrate. Release layer **26** has a thickness sufficient to impart the desired release properties to the release liner sheet **20** of the invention, and typically ranges from about 0.1 micrometers to about 1.6 micrometers.

[0029] The release liners of the invention can be used in combination with other sheet materials as known in the art. For example, adhesive can be applied to the release layer of the release liner sheet so as to form an adhesive layer that is releasably adhered to the release liner. The adhesive layer/release liner composite structure can thereafter be directed into a face-to-face relationship with a suitable substrate (which can be any of the types of substrates described above) to form a release liner/adhesive/substrate structure such that the adhesive layer is sandwiched between the substrate and release liner sheet. The adhesive layer can be formed of various suitable conventional adhesives known in the art, and preferably is a pressure sensitive adhesive. Advantageously a surface thereof opposite the adhesive layer is rendered receptive to printed indicia using techniques known in the art, such as corona treatment, application of an additional layer to the substrate surface which is receptive to printed indicia, and the like. Alternatively, the adhesive may be sandwiched between two release liners to form an unsupported adhesive construction.

[0030] Although the structured polyolefin coated substrate of the invention has been described above as a useful supporting substrate in a release liner application, the structured polyolefin coated substrates of the invention can be used in other applications as well, and are particularly advantageous in printing applications. In this regard, the surface of the substrate opposite the structured polyolefin coated surface can be rendered receptive to printed indicia as described above. The structured substrate has a paper-like surface appearance as a result of the matte finish to the polyolefin coating. However, as discussed above, a matte finish can have frictional characteristics which can cause feeding problems from stacks of sheets or within various types of printers. By imparting a plurality of peaks protruding outwardly from a surface of the polyolefin coating of the substrate, the paper-like appearance of the extrusion coated substrate can be maintained while also providing desirable frictional characteristics, for example, for feeding through laser and ink-jet printers.

[0031] Turning now to Figure 5, an exemplary process for making the structured polyolefin coated substrates of the invention is schematically represented. As shown in Figure 5, a web of a suitable substrate, such as a paper substrate **30**, is directed from a roll (not shown) and guided by rolls **32** and **34** and to a nip formed by a chill roll **36** and a pressure roll **38**. A polyolefin resin is extruded from an extruder **40** in the form of a sheet or film **42** and deposited onto the web **30** of paper. The web of paper **30**, having a layer of extrusion coated resin thereon, is directed between the nip formed by chill roll **36** and pressure roll **38**. The chill roll **36** can be cooled using conventional techniques, such as for example by passing a cooling medium (e.g., water, through the interior thereof). The temperature of the chill roll **36** is generally maintained from about 55° to about 75°F.

[0032] The chill roll **36** is typically a cylindrical metal chill roll with a chromium coating applied to the outer surface thereof. The cylindrical roll can be formed of a variety of metals, such as the various steels, aluminum, and the like, as well as alloys thereof. The chromium coating of the invention initially has a rough surface at least on a microscopic scale, i.e., has a porous or microporous surface or an otherwise physically discontinuous surface. Stated differently the chromium plating surface includes peaks of the chromium material surrounded by pockets or cavities. The chromium coating can be applied using appropriate plating techniques and conditions as known in the art to produce such a rough surface with a desired pattern or plurality of pockets extending into the chromium plating. The outer surface of the chromium plating can then be polished to remove peaks projecting upwardly from the surface of the chromium plating. The resultant chromium plated roll includes a plurality of pockets typically have a depth ranging from about 10 to about 30, preferably from about 13 to about 22, and more preferably from about 15 to about 20 μm. In addition to the pockets, the chill roll also is treated to impart a desired surface roughness to the polished outer cylindrical surface thereof, in this case, to impart a matte finish thereof as defined above. For example, the roll may be gritblasted to produce about a 2.10 μm to 2.79 μm R_a matte finish. Alternative techniques can also be used form pockets extending into the roll, for example, laser engraving of a ceramic or metal roll.

[0033] As the polyolefin resin is extruded from the extruder **40** onto the paper web **30** and the coated paper

passes through the nip formed by rolls **36** and **38**, the polyolefin film is adhered to the paper and simultaneously the film surface forms a replica of the chill roll pattern. Specifically, a plurality of peaks projecting outwardly from the polyolefin coating surface corresponding in height to the depth of the pockets of the chill roll is formed. In addition, the surface area of the polyolefin coating surrounding the projecting peaks will have imparted thereto a matte finish corresponding to that of the surface of the chill roll.

[0034] The laminating pressure between the pressure roll **38** and the chill roll **36** is adjusted and maintained by contacting a pressure back-up roll **50** against the pressure roll **38.** The pressure roll **38** is typically a rubber or rubber covered roll having a Shore A durometer hardness ranging from about 70 to about 95. Other materials having a similar hardness and resiliency as rubber may optionally be used to form the pressure roll **38.** The pressure back-up roll **50** urges the pressure roll **38** toward the chill roll **36** and may itself be cooled by passing a cooling medium such as water through the interior thereof. The pressure between the pressure roll **38** and chill roll **36** as applied by the pressure back-up roll **50** generally ranges from about 14 kN/m to about 140 kN/m, and preferably ranges from about 17.5 kN/m to about 52.5 kN/m.

[0035] Contact with the chill roll cools and sets the polyolefin coating and thereafter the polyolefin coated paper is stripped from the chill roll by roll **44** and guided by rolls **46** and **48** to a winder (not shown).

[0036] The polyolefin resin is extruded from extruder **40** using conventional conditions. For example, as the skilled artisan will appreciate, the polyolefin resin temperature will vary depending upon the specific resin used but typically ranges from about 260°C (500°F) to about 345°C (650°F). The resin is extruded at a rate so as to form a polyolefin layer on the paper web **30** having a thickness ranging from about 13 μm (0.5 mils) to about 51 μm (2.0 mils). The extrusion rate from extruder **40** is coordinated with the paper web running speed, which typically ranges from about 120 meters per minute up to about 460 meters per minute.

[0037] Variations of the extrusion processing conditions will be appreciated by those skilled in the art, such as increasing or decreasing extrusion temperature or web speed, varying the thickness of the polyolefin coating, modification of nip pressure and/or pressure roll hardness, and other process conditions.

[0038] The present invention will be further described by the following non-limiting examples.

[0039] A roll of bleached kraft with a basis weight of 115 grams per square meter (70 pounds/3000 sq. ft.) is mounted on the unwind of the extrusion coater. The paper is passed through the extrusion coater essentially as shown in the schematic diagram. The line speed is 245 mpm and the web tension is about 0.6 kN/m. In the first extrusion coating operation, low density polyethylene (LDPE) is extruded from the first die at a temperature of 320°C into the laminating nip where it contacts the paper. The pressure in the nip is 26 kN/m. The hot LDPE is cooled by contacting a chill roll that has the structured surface of the invention. The structured surface is replicated by the LDPE. The coated paper is further conveyed through the machine, turned over using air turning bars and passed through a second extrusion coating laminating nip. LDPE at 320°C is applied to the uncoated side of the web. The nip pressure is 26 kN/m. The second chill roll is a gloss chill roll, with a surface finish R_a of about 0.05 micrometers that imparts a smooth glossy surface to the LDPE. The paper is then wound up into a roll at the winder.

[0040] Many modifications and other embodiments of the invention will come to mind to one skilled in the art to which this invention pertains having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the invention is not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

Claims

1. A structured polyolefin coated substrate comprising a substrate and a polyolefin coating on a surface thereof, said polyolefin coating having an R_a surface finish ranging from about 1.52 μm to about 3.81 μm and comprising a plurality of peaks protruding outwardly therefrom having an R_z ranging from about 10 μm to about 30 μm.

2. The substrate of Claim 1, wherein said polyolefin coating surface has an R_a surface finish ranging from about 1.80 μm to about 3.04 μm.

3. The substrate of Claim 2, wherein said polyolefin coating surface has an R_a surface finish ranging from about 2.10 μm to about 2.79 μm.

4. The substrate of Claim 1, wherein said peaks have an R_z ranging from about 13 μm to about 22 μm.

5. The substrate of Claim 4, wherein said peaks have an R_z ranging from about 15 μm to about 20 μm.

6. The substrate of Claim 1, wherein said peaks comprise about 0.5 to about 8% of the total surface area of said substrate surface.

7. The substrate of Claim 1, wherein said peaks comprise a plurality of irregularly shaped peaks substantially randomly distributed across the surface of said polyolefin coating.

8. The substrate of Claim 1, wherein said substrate is a polyolefin coated paper substrate.

9. The substrate of Claim 8, wherein said paper substrate has a thickness ranging from about 25.4 μm (1 mil) to about 635 μm (25 mils) and a basis weight ranging from about 20 grams per square meter to about 400 grams per square meter.

10. The substrate of Claim 8, wherein said polyolefin is selected from the group consisting of polyethylene, polypropylene, polymethylpentene, and copolymers, terpolymers and blends thereof.

11. The substrate of Claim 1, wherein said polyolefin coating has a coating weight ranging from about 3.5 grams per square meter to about 47 grams per square meter.

12. The substrate of Claim 11, wherein said polyolefin coating has a coating weight ranging from about 16 grams per square meter to about 28 grams per square meter.

13. A release liner comprising:

a structured polyolefin coated substrate comprising a substrate and a polyolefin coating on a surface thereof, said polyolefin coating having an R_a surface finish ranging from about 1.52 μm to about 3.81 μm and comprising a plurality of peaks protruding outwardly therefrom having an R_z ranging from about 10 μm to about 30 μm; and
a release coating on a surface of said substrate opposite said polyolefin coated surface.

14. A process for making a structured surface substrate, comprising the steps of:

applying a molten polyolefin extrudate onto a surface of a substrate to form a polyolefin coated substrate; and
directing said polyolefin coated substrate through the nip of cooperating rolls, one of said rolls comprising a plurality of pockets having an average depth ranging from about 10 μm to about 30 μm and an R_a surface finish of about 1.52 μm to about 3.81 μm, under conditions sufficient to impart to a surface of said polyolefin coating a plurality of peaks having an average height corresponding to the depth of said pockets and a surface finish corresponding to the R_a surface finish of said roll.

FIG. 1.

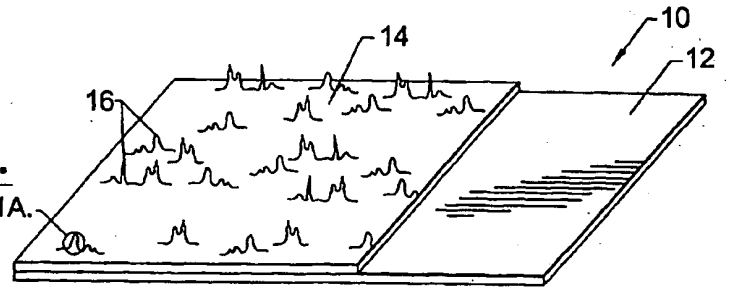

FIG. 1A.

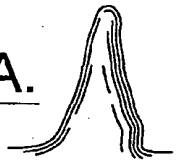

FIG. 2.

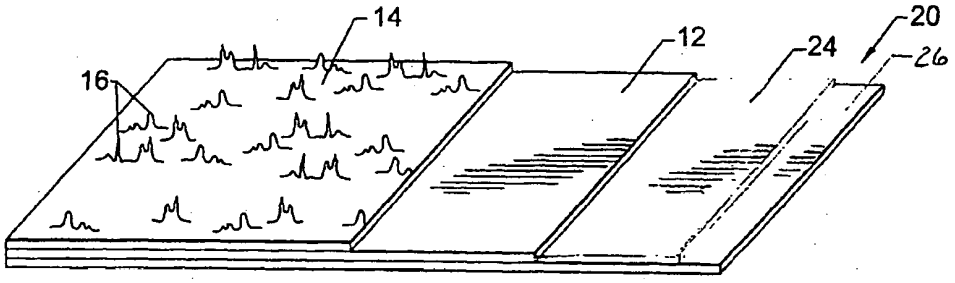

FIG. 4.

FIG. 5.

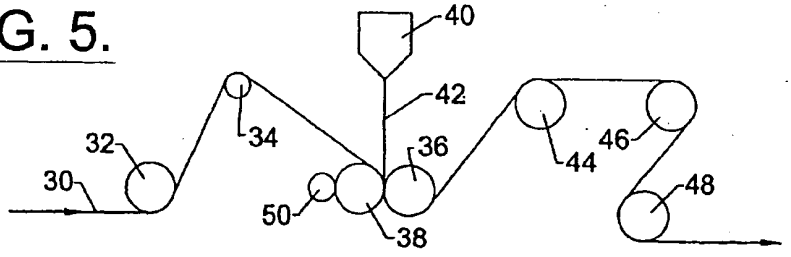

FIGURE 3 SEM photomicrograph of polypropylene-coated EBS paper. 35X magnification.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 11 7876

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
Y	EP 0 396 256 A (UNION CAMP CORP) 7 November 1990 (1990-11-07) * claims 1,6; figure 1; table A *	1-14	D21H19/28 B32B31/30 B32B27/10
Y	US 4 546 029 A (CANCIO LEOPOLDO V ET AL) 8 October 1985 (1985-10-08) * column 5, line 21 - column 6, line 10; claims 1,4 *	1-14	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

D21H
B32B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	16 August 2001	Dupuis, J-L

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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(54) **Structured polyolefin coated substrates and process for making the same**

Strukturierte, mit Polyolefin beschichtete Substrate und Verfahren zur deren Herstellung

Substrats structurés et recouverts de polyolefines et procédé pour leur fabrication

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Description

FIELD OF THE INVENTION

[0001] This invention relates to sheet materials, and more particularly to polyolefin coated sheet materials and processes for making the same.

BACKGROUND OF THE INVENTION

[0002] Polyolefin coated substrates, such as polyethylene coated paper, are known for a variety of applications. The substrates can be prepared having a variety of surface finishes, such as mirror gloss finishes, satin finishes, matte finishes, and structured finishes with peaks or projections protruding outwardly from the surface.

[0003] Polyolefin coated substrates are typically prepared by extruding a molten polyolefin polymer onto the surface of a substrate and directing the resultant coated substrate through the nip of a chill roll and pressure roll. The desired surface appearance is imparted to the polyolefin coating by selection of a chill roll having the appropriate surface characteristics, i.e., a mirror finish to impart a glossy appearance to the polyolefin coating, a pocketed roll to impart peaks to the polyolefin coated surface, and the like.

[0004] EP-A-0 396 256 relates to a process for coating a highly smooth paper substrate with a polyolefin. US-A-4 546 029 relates to a thermoplastic film having a random embossed matte pattern.

[0005] The various surface finishes can be functional, aesthetic, or both in nature. For example, a glossy surface appearance may be desirable in flexible packaging applications. In some applications, however, a given finish is detrimental to the intended function of the product. For example, polyolefin coated substrates having a glossy appearance typically have a very high coefficient of friction. This can cause handling difficulties. For example, the sheets tend to stick together when feeding a stack of glossy sheets into printing equipment.

[0006] To reduce the coefficient of friction of a glossy polyolefin coated substrate, the polymeric surface can be "structured" to impart a plurality of small peaks projecting above the surface of the polyolefin coating. The resultant surface maintains a glossy surface appearance while the creation of numerous peaks on the surface can lower frictional characteristics to improve handling in subsequent operations.

[0007] For many end uses, a glossy appearance is undesirable. For example, many end applications require a paper-like surface appearance, resulting from a matte finish of the polyolefin coating. However, substrates having a matte finish can have too low a coefficient of friction, which can result in handling difficulties as well, particularly when directing such products through manufacturing equipment, laser and/or ink jet printers, and the like. For example, while a stack of matte finish polyolefin coated sheets may separate more easily than glossy sheets, the frictional characteristics of the sheets may be so low that the sheets cannot be adequately "gripped" by guide rollers or other feed mechanisms; as result, the sheets can jam equipment.

SUMMARY OF THE INVENTION

[0008] The present invention is a polyolefin coated substrate in which the polyolefin coating has been structured to impart desirable physical and surface appearance properties thereto. The polyolefin coating has a matte surface finish, and specifically a R_a (Arithmetic Average) surface finish ranging from about 1.52 μm to about 3.81 μm, preferably from about 1.80 μm to about 3.04 μm, and most preferably from about 2.10 μm to about 2.79 μm. In addition, the polyolefin coating includes a plurality of peaks protruding outwardly from the surface thereof, the peaks having an R_z ranging from about 10 μm to about 30 μm, more preferably from about 13 μm to about 22 μm and most preferably from about 15 μm to about 20 μm.

[0009] The polyolefin coated substrate exhibits several desirable yet contradictory properties. The matte finish contributes a paper-like appearance to the substrate. However, in contrast to conventional matte finish polyolefin coated substrates, the structured surface imparts desirable surface frictional properties to the substrate, which in turn improves handling of the product, for example, when directing a stack of the sheets through feeding mechanisms associated with laser printers, digital printers, and the like. It has been found that the structured surface of the matte finish polyolefin coating can improve the frictional characteristics and feeding effectiveness of the sheet material. This is surprising in view of the industry practice of structuring glossy finish polyolefin coated substrates to decrease the frictional characteristics thereof.

[0010] The polyolefin coated substrates of the invention generally include a polyolefin coating on a surface of a suitable support substrate. Any of the types of polyolefin resins known in the art to be useful for coating a substrate can be used, and preferably is a polyethylene or polypropylene resin. Similarly, the support substrate can be any of the types of materials known in the art, but preferably is a paper substrate. The support substrate may have a polyolefin coating on one or both opposing surfaces thereof. When the support substrate includes a polyolefin coating on each surface, the coating may be formed of the same or different polyolefin material and/or may have the same or different surface characteristics, depending upon the desired properties of the product. In addition, a surface of the structured substrate may be treated so that the surface is receptive to printed indicia, for example, by corona treatment, applying an ink receptive coating, and the like.

[0011] The resultant structured polyolefin coated substrates are useful in a variety of applications. For exam-

ple a release coating can be applied to a surface of the substrate opposite the structured polyolefin coating to provide a release liner. The sheets are also useful in printing applications using high speed laser or ink jet printers because the sheets can be readily fed through high speed printing equipment with minimal jams or misfeeds. In yet another application, the structured polyolefin coated substrates can be combined with another substrate, such as a polyvinylchloride (PVC) film.

[0012] The structured polyolefin coated substrates of the invention can be prepared using an extrusion coating process. Specifically, a suitable polyolefin resin is heated and extruded as a molten film or sheet onto a surface of a support substrate. The resultant coated support substrate is then directed through the nip formed by cooperating pressure and chill rolls to set the molten polyolefin coating and adhere it to the support substrate. The chill roll is selected to impart the desired surface characteristics to the polyolefin coating. In this regard a plurality of pockets extend into the chill roll. In addition, the outer surface of the chill roll is treated to impart the desired matte finish. As a result when the molten polyolefin coating on the support substrate is directed against the chill roll surface, the chill roll transfers its surface characteristics to the polyolefin coating, i.e., imparts a plurality of peaks and a surface finish surrounding the peaks having a matte finish. The product can then be directed to a winding roll or immediately directed to additional downstream processing (such as in-line application of a release agent, etc.).

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] Some of the features and advantages of the invention having been described, others will become apparent from the detailed description which follows and from the accompanying drawings, in which:

Figure 1 is a schematic perspective view of a structured polyolefin coated substrate in accordance with the present invention with the respective layers thereof exposed for clarity of illustration;

Figure 1A is a greatly enlarged perspective view illustrating a portion of the surface of the structured polyolefin coated substrate of Figure 1, taken within ring 1A of Figure 1;

Figure 2 is a greatly enlarged cross sectional view of the structured polyolefin coated substrate of Figure 1;

Figure 3 is a photomicrograph at 35X magnification of a structured polypropylene coated paper substrate in accordance with one embodiment of the invention;

Figure 4 is a schematic perspective view of a release liner in accordance with the present invention which includes a structured polyolefin coated substrate as a component; and

Figure 5 is a schematic representation of an exemplary process for making the structured polyolefin coated substrates of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0014] The present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout.

[0015] Figure 1 is a schematic perspective view of a structured polyolefin coated substrate in accordance with the present invention, designated generally as **10**. In Figure 1, the respective layers of the structured polyolefin coated material **10** are cut away or exposed for clarity of illustration. Generally, structured polyolefin coated substrate **10** includes a support substrate **12** and a polyolefin coating **14** on a surface thereof.

[0016] As illustrated in Figure 1, in the invention, the surface topography of the polyolefin coated substrate **10** is modified to include a plurality of peaks or projections **16** projecting outwardly from the polyolefin coating surface. Figure 1A is a greatly enlarged perspective view of such a peak or projection **16** taken within ring 1A of Figure 1. Figure 2 is a greatly enlarged cross sectional view of the structured polyolefin coated substrate of Figure 1 and also illustrates peaks **16** projecting upwardly from the outer surface of the polyolefin coating **14**. It is noted that the surface topography of polyolefin coating **14** as illustrated in Figures 1, 1A, 2 and 4 is greatly enlarged for illustrative purposes and is not to scale.

[0017] Peaks **16** can vary in height and generally have an R_z ranging from about 10 μm to about 30 μm, preferably ranging from about 13 μm to about 22 μm, and most preferably ranging from about 15 μm to about 20 μm. As used herein, the average height of the peaks or projections is determined using any of several well-known surface profiling devices such as those available from WYKO or Tencor. The height of individual peaks can vary, but preferably the height variations are randomly distributed so that a number of shorter, or higher, peaks are not grouped together.

[0018] The opposing surface of the polyolefin coated substrate opposite the polyolefin coating **14** could also include a plurality of peaks projecting outwardly from the opposing surface. For example, both surfaces of the support substrate **12** can be coated with a polyolefin coating, and each of the polyolefin coatings can in turn can be topographically structured or modified.

[0019] The spacing of peaks **16** can also vary, and preferably the peaks are spaced apart to provide a contact surface of the peaks of about 0.5 to about 8 percent,

preferably about 1.5 to about 4 percent, of the total surface area of the polyolefin coating **14** and a matte polyolefin coating surface area between the peaks of about 92 percent or greater of the total polyolefin coating layer.

[0020] The outer surface of the polyolefin coating **14** between the peaks **16** is characterized as having a matte finish. As used herein, the term "matte finish" refers to a surface property characterized as having an R_a (Arithmetic Average) surface finish ranging from about 1.52 μm to about 3.81 μm, preferably ranging from about 1.80 μm to about 3.04 μm, and more preferably from about 2.10 μm to about 2.79 μm. The R_a surface finish or roughness of the surface area of the polyolefin coating between the peaks **16** is determined by any of several well-known surface profiling devices such as WYKO or Tencor devices. The matte surface topography is not illustrated in the figures by reason of the small scale.

[0021] Thus, as illustrated in Figures 1, 1A, and 2, the structured polyolefin coatings of the coated substrates of the invention in currently preferred embodiments of the invention include projecting peaks that are typically irregularly shaped and randomly located across the surface of the polyolefin coating. Stated differently, the structured polyolefin surface can be described as having a generally randomized surface topography characterized by a plurality of peaks projecting upwardly therefrom and a matte surface finish between the peaks. As used herein the term "randomly located across the surface of the polyolefin coating" means that the projecting peaks do not necessarily line up in regular arrays of peaks (for example as linear columns and rows of peaks). Also as used herein the term "irregularly shaped" means that the peaks generally do not have a symmetrical cross sectional configuration (such as a conical cross section).

[0022] Figure 3 is a photomicrograph of a polyolefin coated substrate in accordance with one aspect of the invention. Specifically, Figure 3 illustrates a top plan view of a polypropylene coated paper substrate at 35X magnification. As illustrated therein, the polypropylene surface includes a plurality of peaks and surrounding matte surface area.

[0023] Support substrate **12** can be any of the types of substrates as known in the art, including without limitation polymeric substrates, such as polymer films (including metallized and voided films), polymer foams, sheets formed of synthetic staple fibers and/or filaments, and the like; cellulosic substrates, such as paper substrates (including metallized paper); substrates including both polymeric and cellulosic components, for example, sheets formed of a blend or mixture of synthetic and cellulosic staple fibers and/or filaments; metal foils; and the like.

[0024] Preferably support substrate **12** is a cellulosic substrate, and more preferably a paper substrate. Any of the types of papers conventionally known in the art for preparing coated papers can be used in the invention, such as but not limited to kraft paper, natural or synthetic pulp paper, paperboard, liner board, and the like. The paper may additionally contain conventional paper adjuvants, such as but not limited to strength increasing agents, sizing agents, dyes, fluorescent whitening agents, preservatives, fillers, antistatic agents, clay, kaolin, talc, barium sulfate, calcium carbonate, titanium dioxide, zinc oxide, and the like.

[0025] The thickness of the paper may range from about 25.4 μm (1 mil) to about 635 μm (25 mils), preferably from about 64 μm (2.5 mils) to about 381 μm (15 mils), and more preferably about 102 μm (4 mils) to about 254 μm (10 mils). The basis weight of the paper sheet generally ranges from about 20 grams per square meter to about 400 grams per square meter, although again as the skilled artisan will appreciate, paper substrates having a basis weight outside of this range can also be used. The paper can be uncoated or coated, machine finished, machine glazed, soft-nip calendered, super-calendered, bleached, semi-bleached, natural, or colored paper as known in the art.

[0026] Polyolefin coating **14** can be formed of any of the types of polyolefin resin materials known in the art useful for coating a substrate. Examples of polyolefin resins include ethylene homopolymers, copolymers, and terpolymers, such as high density polyethylene, low density polyethylene, and linear low density polyethylene; propylene homopolymers; polymethylpentene hompolymers; and copolymers, terpolymers, and blends thereof. Examples of copolymerizable monomers include alpha olefins such as styrene, vinyl acetate, acrylic acid, methyl acrylate, ethyl acrylate, acrylamide, methacrylic acid, methyl methacrylate, ethyl methacrylate, methacrylamide, 1-butene, 1-hexene, 1-octene, and diene compounds such as butadiene and isoprene. The polyolefin resin can be employed alone or in combination as in a coextruded coating. The coating weight of the polyolefin coating layer **14** can vary, and typically ranges from about 3.5 grams per square meter to about 47 grams per square meter, preferably from about 16 grams per square meter to about 28 grams per square meter, although coating weights outside of these ranges can also be used.

[0027] The polyolefin may further contain a variety of additives as known in the art, such as but not limited to fluorescent agents, whitening agents, anti-oxidizing agents, antistatic agents, releasing agents, dyes, dispersing agents, pigments, fillers and the like. The thickness of the polyolefin coating can vary, typically ranging from about 10 μm (0.4 mils) to about 51 μm (2 mils), and preferably from about 18 μm (0.7 mils) to about 31 μm (1.2 mils).

[0028] Turning now to Figure 4, another aspect of the invention is illustrated, specifically, a release liner designated generally as **20**. Release liner **20** includes a supporting or carrier substrate, such as the structured polyolefin coated substrate **10** of Figure 1. Release liner **20** also includes one or more additional and optional poly-

olefin layers, such as polyolefin layer **24** in Figure 4 and a release layer **26** on a surface of the substrate opposite the structured polyolefin coating. As noted above, such additional polyolefin coatings, such as layer **24**, can be topographically structured or modified, although not required.

[0029] Release layer **26** can include any of the types of agents known in the art which impart release properties to a substrate. For example, release layer **26** can be a coating of a release agent, such as a fluoropolymer, silicone, chromium complexes of long chain fatty acids, and the like. Typically, such release agents are cured by any of several techniques, such as by heat, by electromagnetic radiation, such as ultraviolet (UV), electron beam, and the like, by moisture, and the like, as known in the art. Release layer **26** can also be cured by evaporative processes as known in the art, i.e., dried to remove solvent. Exemplary release agents include without limitation SYL-OFF® 294 with Dow Corning 176 Catalyst, commercially available from Dow Corning; UV9315 with UV9310C catalyst, commercially available from General Electric Silicones, and Quilon®, commercially available from E.I. DuPont. Corona treatment can advantageously be used to promote adhesion of the release agent to the surface of the structured polyolefin coated substrate. Release layer **26** has a thickness sufficient to impart the desired release properties to the release liner sheet **20** of the invention, and typically ranges from about 0.1 micrometers to about 1.6 micrometers.

[0030] The release liners of the invention can be used in combination with other sheet materials as known in the art. For example, adhesive can be applied to the release layer of the release liner sheet so as to form an adhesive layer that is releasably adhered to the release liner. The adhesive layer/release liner composite structure can thereafter be directed into a face-to-face relationship with a suitable substrate (which can be any of the types of substrates described above) to form a release liner/adhesive/substrate structure such that the adhesive layer is sandwiched between the substrate and release liner sheet. The adhesive layer can be formed of various suitable conventional adhesives known in the art, and preferably is a pressure sensitive adhesive. Advantageously a surface thereof opposite the adhesive layer is rendered receptive to printed indicia using techniques known in the art, such as corona treatment, application of an additional layer to the substrate surface which is receptive to printed indicia, and the like. Alternatively, the adhesive may be sandwiched between two release liners to form an unsupported adhesive construction.

[0031] Although the structured polyolefin coated substrate of the invention has been described above as a useful supporting substrate in a release liner application, the structured polyolefin coated substrates of the invention can be used in other applications as well, and are particularly advantageous in printing applications. In this regard, the surface of the substrate opposite the structured polyolefin coated surface can be rendered receptive to printed indicia as described above. The structured substrate has a paper-like surface appearance as a result of the matte finish to the polyolefin coating. However, as discussed above, a matte finish can have frictional characteristics which can cause feeding problems from stacks of sheets or within various types of printers. By imparting a plurality of peaks protruding outwardly from a surface of the polyolefin coating of the substrate, the paper-like appearance of the extrusion coated substrate can be maintained while also providing desirable frictional characteristics, for example, for feeding through laser and ink-jet printers.

[0032] Turning now to Figure 5, an exemplary process for making the structured polyolefin coated substrates of the invention is schematically represented. As shown in Figure 5, a web of a suitable substrate, such as a paper substrate **30**, is directed from a roll (not shown) and guided by rolls **32** and **34** and to a nip formed by a chill roll **36** and a pressure roll **38**. A polyolefin resin is extruded from an extruder **40** in the form of a sheet or film **42** and deposited onto the web **30** of paper. The web of paper **30**, having a layer of extrusion coated resin thereon, is directed between the nip formed by chill roll **36** and pressure roll **38**. The chill roll **36** can be cooled using conventional techniques, such as for example by passing a cooling medium (e.g., water, through the interior thereof). The temperature of the chill roll **36** is generally maintained from about 12.8°C (55°F) to about 23.9°C (75°C).

[0033] The chill roll **36** is typically a cylindrical metal chill roll with a chromium coating applied to the outer surface thereof. The cylindrical roll can be formed of a variety of metals, such as the various steels, aluminum, and the like, as well as alloys thereof. The chromium coating of the invention initially has a rough surface at least on a microscopic scale, i.e., has a porous or microporous surface or an otherwise physically discontinuous surface. Stated differently the chromium plating surface includes peaks of the chromium material surrounded by pockets or cavities. The chromium coating can be applied using appropriate plating techniques and conditions as known in the art to produce such a rough surface with a desired pattern or plurality of pockets extending into the chromium plating. The outer surface of the chromium plating can then be polished to remove peaks projecting upwardly from the surface of the chromium plating. The resultant chromium plated roll includes a plurality of pockets typically have a depth ranging from about 10 to about 30, preferably from about 13 to about 22, and more preferably from about 15 to about 20 μm. In addition to the pockets, the chill roll also is treated to impart a desired surface roughness to the polished outer cylindrical surface thereof, in this case, to impart a matte finish thereof as defined above. For example, the roll may be gritblasted to produce about a 2.10 μm to 2.79 μm R_a matte finish. Alternative techniques can also be used form pockets extending into the

roll, for example, laser engraving of a ceramic or metal roll.

[0034] As the polyolefin resin is extruded from the extruder **40** onto the paper web **30** and the coated paper passes through the nip formed by rolls **36** and **38**, the polyolefin film is adhered to the paper and simultaneously the film surface forms a replica of the chill roll pattern. Specifically, a plurality of peaks projecting outwardly from the polyolefin coating surface corresponding in height to the depth of the pockets of the chill roll is formed. In addition, the surface area of the polyolefin coating surrounding the projecting peaks will have imparted thereto a matte finish corresponding to that of the surface of the chill roll.

[0035] The laminating pressure between the pressure roll **38** and the chill roll **36** is adjusted and maintained by contacting a pressure back-up roll **50** against the pressure roll **38**. The pressure roll **38** is typically a rubber or rubber covered roll having a Shore A durometer hardness ranging from about 70 to about 95. Other materials having a similar hardness and resiliency as rubber may optionally be used to form the pressure roll **38**. The pressure back-up roll **50** urges the pressure roll **38** toward the chill roll **36** and may itself be cooled by passing a cooling medium such as water through the interior thereof. The pressure between the pressure roll **38** and chill roll **36** as applied by the pressure back-up roll **50** generally ranges from about 14 kN/m to about 140 kN/m, and preferably ranges from about 17.5 kN/m to about 52.5 kN/m.

[0036] Contact with the chill roll cools and sets the polyolefin coating and thereafter the polyolefin coated paper is stripped from the chill roll by roll **44** and guided by rolls **46** and **48** to a winder (not shown).

[0037] The polyolefin resin is extruded from extruder **40** using conventional conditions. For example, as the skilled artisan will appreciate, the polyolefin resin temperature will vary depending upon the specific resin used but typically ranges from about 260°C (500°F) to about 345°C (650°F). The resin is extruded at a rate so as to form a polyolefin layer on the paper web **30** having a thickness ranging from about 13 μm (0.5 mils) to about 51 μm (2.0 mils). The extrusion rate from extruder **40** is coordinated with the paper web running speed, which typically ranges from about 120 meters per minute up to about 460 meters per minute.

[0038] Variations of the extrusion processing conditions will be appreciated by those skilled in the art, such as increasing or decreasing extrusion temperature or web speed, varying the thickness of the polyolefin coating, modification of nip pressure and/or pressure roll hardness, and other process conditions.

[0039] The present invention will be further described by the following non-limiting examples.

[0040] A roll of bleached kraft with a basis weight of 115 grams per square meter (70 pounds/3000 sq. ft.) is mounted on the unwind of the extrusion coater. The paper is passed through the extrusion coater essentially as shown in the schematic diagram. The line speed is 245 mpm and the web tension is about 0.6 kN/m. In the first extrusion coating operation, low density polyethylene (LDPE) is extruded from the first die at a temperature of 320°C into the laminating nip where it contacts the paper. The pressure in the nip is 26 kN/m. The hot LDPE is cooled by contacting a chill roll that has the structured surface of the invention. The structured surface is replicated by the LDPE. The coated paper is further conveyed through the machine, turned over using air turning bars and passed through a second extrusion coating laminating nip. LDPE at 320°C is applied to the uncoated side of the web. The nip pressure is 26 kN/m. The second chill roll is a gloss chill roll, with a surface finish R_a of about 0.05 micrometers that imparts a smooth glossy surface to the LDPE. The paper is then wound up into a roll at the winder.

[0041] Many modifications and other embodiments of the invention will come to mind to one skilled in the art to which this invention pertains having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the invention is not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

Claims

1. A structured polyolefin coated substrate comprising a substrate and a polyolefin coating on a surface thereof, **characterized in that** the polyolefin coating having an R_a surface finish ranging from about 1.52 μm to about 3.81 μm and comprising a plurality of peaks protruding outwardly therefrom having an R_z ranging from about 10 μm to about 30 μm.

2. The substrate of Claim 1, wherein said polyolefin coating surface has an R_a surface finish ranging from about 1.80 μm to about 3.04 μm.

3. The substrate of Claim 2, wherein said polyolefin coating surface has an R_a surface finish ranging from about 2.10 μm to about 2.79 μm.

4. The substrate of Claim 1, wherein said peaks have an R_z ranging from about 13 μm to about 22 μm.

5. The substrate of Claim 4, wherein said peaks have an R_z ranging from about 15 μm to about 20 μm.

6. The substrate of Claim 1, wherein said peaks comprise about 0.5 to about 8% of the total surface area of said substrate surface.

7. The substrate of Claim 1, wherein said peaks comprise a plurality of irregularly shaped peaks substantially randomly distributed across the surface of said polyolefin coating.

8. The substrate of Claim 1, wherein said substrate is a polyolefin coated paper substrate.

9. The substrate of Claim 8, wherein said paper substrate has a thickness ranging from about 25.4 μm (1 mil) to about 635 μm (25 mils) and a basis weight ranging from about 20 grams per square meter to about 400 grams per square meter.

10. The substrate of Claim 8, wherein said polyolefin is selected from the group consisting of polyethylene, polypropylene, polymethylpentene, and copolymers, terpolymers and blends thereof.

11. The substrate of Claim 1, wherein said polyolefin coating has a coating weight ranging from about 3.5 grams per square meter to about 47 grams per square meter.

12. The substrate of Claim 11, wherein said polyolefin coating has a coating weight ranging from about 16 grams per square meter to about 28 grams per square meter.

13. A release liner comprising:

a structured polyolefin coated substrate comprising a substrate and a polyolefin coating on a surface thereof, said polyolefin coating having an R_a surface finish ranging from about 1.52 μm to about 3.81 μm and comprising a plurality of peaks protruding outwardly therefrom having an R_z ranging from about 10 μm to about 30 μm; and
a release coating on a surface of said substrate opposite said polyolefin coated surface.

14. A process for making a structured surface substrate, comprising the steps of:

applying a molten polyolefin extrudate onto a surface of a substrate to form a polyolefin coated substrate; and
directing said polyolefin coated substrate through the nip of cooperating rolls, one of said rolls comprising a plurality of pockets having an average depth ranging from about 10 μm to about 30 μm and an R_a surface finish of about 1.52 μm to about 3.81 μm, under conditions sufficient to impart to a surface of said polyolefin coating a plurality of peaks having an average height corresponding to the depth of said pockets and a surface finish corresponding to the R_a surface finish of said roll.

Patentansprüche

1. Ein strukturiertes, mit Polyolefin beschichtetes Substrat umfassend ein Substrat und eine Polyolefinbeschichtung auf einer Oberfläche davon, **dadurch gekennzeichnet, dass** die Polyolefinbeschichtung einen R_a-Oberflächenzustand im Bereich von ca. 1.52 um bis ca. 3.81 um aufweist und eine Vielzahl an Spitzen umfasst, die davon mit einem R_z im Bereich von ca. 10 μm bis ca. 30 um nach aussen abstehen.

2. Das Substrat nach Anspruch 1, in dem die Oberfläche der Polyolefinbeschichtung einen R_a-Oberflächenzustand im Bereich von ca. 1.80 um bis ca. 3.04 um aufweist.

3. Das Substrat nach Anspruch 2, in dem die Oberfläche der Polyolefinbeschichtung einen R_a-Oberflächenzustand im Bereich von ca. 2.10 um bis ca. 2.79 um aufweist.

4. Das Substrat nach Anspruch 1, in dem die Spitzen einen R_z im Bereich von ca. 13 μm bis ca. 22 um aufweisen.

5. Das Substrat nach Anspruch 4, in dem die Spitzen einen R_z im Bereich von ca. 15 μm bis ca. 20 μm aufweisen.

6. Das Substrat nach Anspruch 1, in dem die Spitzen ca. 0.5 bis ca. 8% der Gesamtfläche der Substratoberfläche umfassen.

7. Das Substrat nach Anspruch 1, in dem die Spitzen eine Vielzahl an unregelmässig geformten Spitzen umfassen, welche im wesentlichen zufällig über die Oberfläche der Polyolefinbeschichtung verteilt sind.

8. Das Substrat nach Anspruch 1, in dem das Substrat ein mit Polyolefin beschichtetes Papiersubstrat ist.

9. Das Substrat nach Anspruch 8, in dem das Papiersubstrat eine Dicke im Bereich von ca. 25.4 μm (1 mil) bis ca. 635 μm (25 mil) und ein Basisgewicht im Bereich von ca. 20 Gramm pro Quadratmeter bis ca. 400 Gramm pro Quadratmeter aufweist.

10. Das Substrat nach Anspruch 8, in dem das Polyolefin ausgewählt ist aus der Gruppe bestehend aus Polyethylen, Polypropylen, Polymethylpenten sowie Copolymeren, Terpolymeren und Mischungen davon.

11. Das Substrat nach Anspruch 1, in dem die Polyolefinbeschichtung ein Beschichtungsgewicht im Bereich von ca. 3.5 Gramm pro Quadratmeter bis ca. 47 Gramm pro Quadratmeter aufweist.

12. Das Substrat nach Anspruch 11, in dem die Polyolefinbeschichtung ein Beschichtungsgewicht im Bereich von ca. 16 Gramm pro Quadratmeter bis ca. 28 Gramm pro Quadratmeter aufweist.

13. Eine Trenn-Decklage enthaltend:

ein strukturiertes, mit Polyolefin beschichtetes Substrat enthaltend ein Substrat und eine Polyolefinbeschichtung auf einer Oberfläche davon, wobei die Polyolefinbeschichtung einen R_a-Oberflächenzustand im Bereich von ca. 1.52 µm bis ca. 3.81 µm aufweist und eine Vielzahl an Spitzen umfasst, die davon mit einem R_z im Bereich von ca. 10 µm bis ca. 30 µm nach aussen abstehen; und

eine Trennbeschichtung auf einer der mit Polyolefin beschichteten Oberfläche gegenüberliegenden Oberfläche das Substrats.

14. Ein Verfahren zur Herstellung eines Substrates mit strukturierter Oberfläche umfassend die folgenden Schritte:

das Auftragen eines geschmolzenen Polyolefinextrudates auf eine Oberfläche eines Substrates, um ein mit Polyolefin beschichtetes Substrat zu bilden; und

das Führen des mit Polyolefin beschichteten Substrates durch den Walzenspalt zusammenwirkender Walzen, wobei eine der Walzen eine Vielzahl an Taschen mit einer durchschnittlichen Tiefe im Bereich von ca. 10 µm bis ca. 30 um und einen R_a-Oberflächenzustand im Bereich von ca. 1.52 um bis ca. 3.81 µm aufweist, unter Bedingungen, die ausreichend sind, einer Oberfläche der Polyolefinbeschichtung eine Vielzahl an Spitzen mit einer der Tiefe der Taschen entsprechenden durchschnittlichen Höhe und einem dem R_a-Oberflächenzustand der Walze entsprechenden Oberflächenzustand zu verleihen.

Revendications

1. Substrat revêtu d'une polyoléfine structurée comprenant un substrat et un revêtement de polyoléfine sur une surface dudit substrat, **caractérisé en ce que** le revêtement de polyoléfine a un état de surface R_a compris entre environ 1,52 µm et environ 3,81 µm et il comprend, saillant vers l'extérieur depuis celui-ci, une pluralité de pics ayant un R_z compris entre environ 10 µm et environ 30 µm.

2. Substrat selon la revendication 1, dans lequel ladite surface de revêtement de polyoléfine a un état de surface R_a compris entre environ 1,80 µm et environ 3,04 µm.

3. Substrat selon la revendication 2, dans lequel ladite surface de revêtement de polyoléfine a un état de surface R_a compris entre environ 2,10 µm et environ 2,79 µm.

4. Substrat selon la revendication 1, dans lequel lesdits pics ont un R_z compris entre environ 13 µm et environ 22 µm.

5. Substrat selon la revendication 4, dans lequel lesdits pics ont un R_z compris entre environ 15 µm et environ 20 µm.

6. Substrat selon la revendication 1, dans lequel lesdits pics représentent d'environ 0,5 à environ 8% de la superficie totale de ladite surface de substrat.

7. Substrat selon la revendication 1, dans lequel lesdits pics comprennent une pluralité de pics de formes irrégulières distribués de façon sensiblement aléatoire d'un côté à l'autre de la surface dudit revêtement de polyoléfine.

8. Substrat selon la revendication 1, dans lequel ledit substrat est un substrat en papier revêtu d'une polyoléfine.

9. Substrat selon la revendication 8, dans lequel ledit substrat en papier a une épaisseur comprise entre environ 25,4 µm (1 millième de pouce) et environ 635 µm (25 millièmes de pouce) et une masse surfacique comprise entre environ 20 g/m^2 et environ 400 g/m^2.

10. Substrat selon la revendication 8, dans lequel ladite polyoléfine est sélectionnée dans le groupe consistant en le polyéthylène, le polypropylène, le polyméthylpentène, et les copolymères, terpolymères et mélanges de ceux-ci.

11. Substrat selon la revendication 1, dans lequel ledit revêtement de polyoléfine a un poids de revêtement compris entre environ 3,5 g/m^2 et environ 47 g/m^2.

12. Substrat selon la revendication 11, dans lequel ledit revêtement de polyoléfine a un poids de revêtement compris entre environ 16 g/m^2 et environ 28 g/m^2.

13. Doublure anti-adhérente, comprenant :

un substrat revêtu d'une polyoléfine structurée comprenant un substrat et un revêtement de polyoléfine sur une surface dudit substrat, ledit revêtement de polyoléfine ayant un état de surface R_a compris entre environ 1,52 µm et environ 3,80 µm et comprenant, saillant vers l'extérieur depuis celui-ci, une pluralité de pics ayant un R_z compris entre environ 10 µm et environ 30 µm ; et
un revêtement anti-adhérent sur une surface dudit substrat à l'opposé de la surface revêtue de polyoléfine.

14. Procédé de fabrication d'un substrat à surface structurée, comprenant les étapes suivantes :

l'application d'un extrudat fondu de polyoléfine sur une surface d'un substrat pour former un substrat revêtu de polyoléfine ; et
le fait de diriger ledit substrat revêtu de polyoléfine au travers de l'espace-pinceur de rouleaux coopérants, l'un desdits rouleaux comprenant une pluralité de poches ayant une profondeur moyenne comprise entre environ 10 µm et environ 30 µm et un état de surface R_a compris entre environ 1,52 µm et environ 3,81 µm, dans des conditions suffisantes pour conférer à une surface dudit revêtement de polyoléfine une pluralité de pics ayant une hauteur moyenne correspondant à la profondeur desdites poches et un état de surface correspondant à l'état de surface R_a dudit rouleau.

FIG. 1.

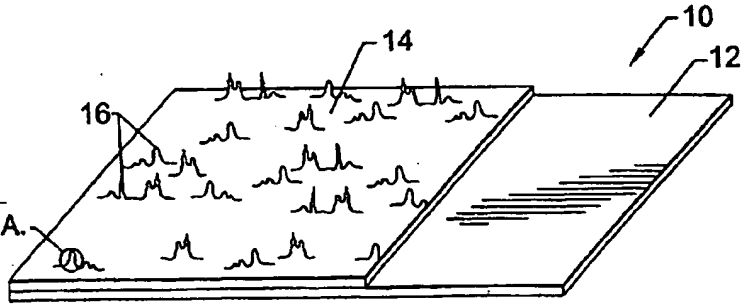

FIG. 1A.

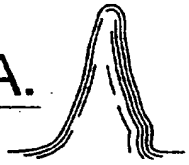

FIG. 2.

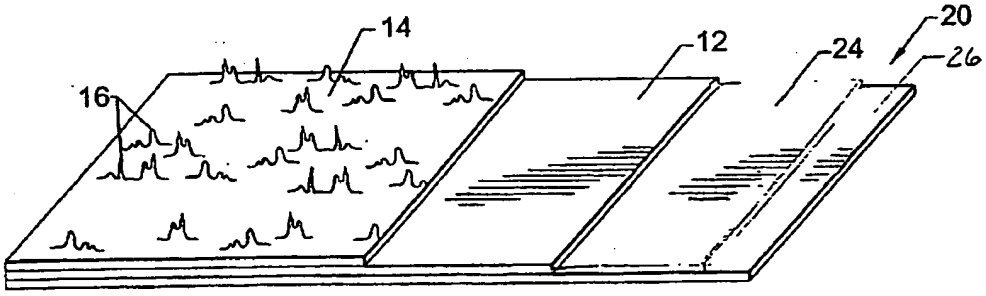

FIG. 4.

FIG. 5.

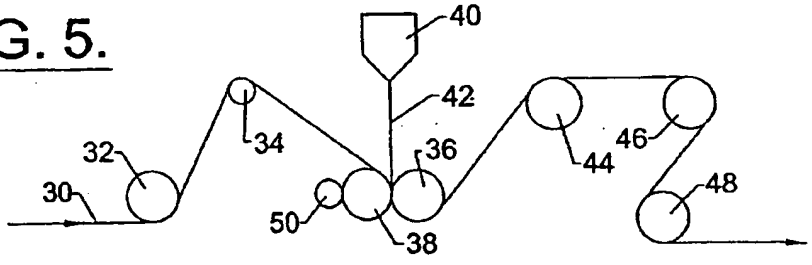

FIGURE 3 SEM photomicrograph of polypropylene-coated EBS paper. 35X magnification.